HAER NO. MT-138-H

MALMSTROM AIR FPRCE BASE,564th MISSILE SQUAADRON
QUEBEC LF-19
STATE ROUTE 417
VICINITY OF SHELBY
TOOLE COUNTY
MONTANA

PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

HISTORIC AMERICAN ENGINEERING RECORD
Intermountain Support Office - Denver
National Park Service
P.O. Box 25287
Denver, Colorado 80225-0287

HISTORIC AMERICAN ENGINEERING RECORD

MALMSTROM AIR FORCE BASE, 546th MISSILE SQUADRON
QUEBEC-19 LAUNCH FACILITY

HAER NO. MT-138-H

Location:	On State Route 417 south-southeast of Shelby, east of I-15 in the Northeast ¼ of the Northwest ¼ of Section 13, Township 30 North, Range 1 West.
UTM:	Zone 12 / 449617 Easting / 5356832 Northing
County:	Toole County, Montana
Date of Construction	Constructed as a Minuteman II system in 1965-1966; converted to a Minuteman III system in 1975
Architect:	Ralph M. Parson Company
Builder:	Morrison Knudsen Company and Associates
Present Owner:	Malmstrom Air Force Base (MAFB), US Air Force (USAF)
Present Use:	Deactivated Minuteman III Launch Facility (LF)
Significance:	The Quebec-19 Launch Facility is one of 50 LFs associated with the 564th, a Minuteman Intercontinental Ballistic Missile (ICBM) squadron based at Malmstrom Air Force Base, Montana. The LF is an unmanned below-ground silo which stores a fueled missile ready for launch. In common with other Minuteman installations in the nation, the 564th Missile Squadron's (MS) missiles were grouped in tens, with each grouping oriented around a single Missile Alert Facility (MAF). Each MAF housed the personnel and equipment required to remotely monitor, control and command operations at its 10 associated LFs.

The Quebec-19 and two other 564th LFs were determined representative examples of the infrastructure and unique technological system developed in response to the nation's Cold War defense and strategic deterrence needs. As such, they are historically significant for their association with the late twentieth-century defense policy of the United States. Military leaders found the rural Montana countryside surrounding Malmstrom Air Force ideally suited the needs of the Minuteman program, being situated within striking range of the Soviet Union. Of greater importance was the region's low population density which meant comparatively minimal loss of life in the event of nuclear attack.

Additionally, the Quebec-19 LF embodies some key aspects defining the Minuteman's technological superiority over its ICBM predecessors. Top among these were consolidation of missile fuel, storage and launch activities into a single facility, and development of a larger and far more effective warhead. Launch of a Minuteman missile could occur within less than one minute after appropriated command.

The Quebec-19 LF is also significant as representations of the architectural evolution of the LF. In addition to modifications for accommodating larger missiles, other design improvements to the Minuteman I LF centered on improving the survivability of the missile itself as well as possible maintenance crews on-site in the event of nuclear attack. Although of blast-resistant hard construction, a Minuteman I's underground missile silo was still highly-vulnerable to the severe ground tremors associated with the spread of nuclear radiation, while no hard life support facilities had been provided. Minuteman II designers addressed the need for bettering the prospect of missile survival by equipping silos with shock absorbing devices to maintain the structure completely steady if hit by nuclear tremors. Additionally, equipment needed to maintain the missile on prolonged strategic alert was relocated from a soft to a hard structure, also complete with shock absorbers. That same hard structure was fitted with life support facilities as well. It was expected to sustain a livable environment for two weeks after attack. Conversion of a Minuteman II LF to a Minuteman III retained those improvements.

Introduction

The Quebec-19 LF is a remote, unmanned Minuteman missile storage and launch facility located in the isolated rural countryside of north-central Montana. It is one of 10 LFs attached to the 564th Missile Squadron's Quebec Missile Alert Facility (MAF). MAFs contain the personnel and equipment required to continually control and monitor the LFs and missiles. The Quebec LFs encircle the Quebec MAF, with each LF at least 3 miles from adjacent LF as well as at least 3 miles distant from the MAF. The 564th Missile Squadron (MS) commands four other missile fields, in addition to the Quebec.

The Quebec-19 LF is on State Route 417 north of the town of Ledger, in Toole County. Interstate 15 runs approximately 20.3 miles to the west and State Route 366 is 6.9 miles north. The Quebec-19 LF occupies 6 acres, although only a portion of the property is fenced. The surrounding area is characterized by rolling topography and very few domestic or agricultural buildings are within the LF's viewshed.

The USAF named and numbered its Minuteman installations in a specific way. Facility names, such as Quebec, came alphabetically, so the 564th MS, being the youngest squadron in the 341st MW, were named with the letters P, Q, R, S, and T. LFs were also numbered in a specific way, with the associated MAF (in this case, Quebec MAF) numbered 0 and the LFs numbered in increments of ten. Under this naming scheme, Quebec MAF is referred to as Q-0 while the ten associated Quebec LFs are referred to as Q-11 to Q-20. The remaining four MAFs and associated LFs are numbered in a similar fashion. Papa MAF is P-0 with LFs referred to as P-1 to P-10; Romeo is R-0 with LFs R-21 to R-30; Sierra MAF is S-0 with LFs S-31 to 40; and Tango MAF is T-0 with LFs T-41 to T-50. The number of the LF corresponds with a rough geographic arrangement around its centrally-located MAF.

The Quebec and the 564th MS's four other missile fields were initially Minuteman II installations, all constructed in 1965-1966. The Ralph A. Parson Company of Los Angeles, California was the project architect, and Morrison Knudsen Company and Associates the construction contractor. The USAF converted all four MAFs and their associated LFs -- including the Quebec-19 -- from Minuteman II to Minuteman III installations in 1975.

Evolution of Minuteman Missile Launcher Facilities

The question of how to store and launch an ICBM was problematic from its initial development and consequently, launch facilities went through several evolutions prior to the development of the Minuteman missile. The Atlas missile provided early experience with storing and launching a land-based missile prior to the 1960s. The Atlas had four types of launch facilities developed as the missile was upgraded: launch from a vertical above-ground launcher; horizontal storage in a warehouse that had a retractable roof; storage in a concrete building (called a coffin) which was then vertically raised before launch; and finally vertical storage in an underground silo before the missile was ultimately raised to the surface for launch. Although this final scheme allowed for fuel to be loaded within the missile during storage, highly volatile liquid oxygen still had to be added prior to launch, which made the system somewhat time-intensive.

The Titan missile launch facilities initially duplicated the Atlas pattern. The Titan missile was also stored vertically underground, fueled just prior to launch while still in the silo, and then raised to the surface for an above-ground launch. However, as the Titan missile evolved, its launch facility did as well, and by the time the final Titan missile was developed, the USAF had developed the capability to store and launch a missile from its launch facility by storing the missile and its fuel propellants together in the silo. While this made the Titan more efficient than its predecessors, the LF required constant care and attention. A full-time crew remained on-site to monitor the Titan missile site, making it an inefficient system both financially and technologically.

Development a solid rocket propellant which allowed storage of a Minuteman missile fueled and ready for immediate launch proved a major advancement in the nation's ICBM program. The below-ground storage and above-ground launch design was replaced with a design that had every element of the missile below ground, including storage, fueling, repair, and launch. Improvement of the missile itself and its storage and launch technologies made the Minuteman one of the most efficient missiles of its time. The entire span of time from launch to arrival at its target took half the time of the Atlas and Titan fueling process alone.

Another important component of the Minuteman program centered on the fact that a perpetual on-site crew was no longer needed at the launch facility. A Minuteman missile did not have the 300,000 parts of the Atlas and Titan missiles which significantly reduced maintenance and repair requirements, and made them less sensitive and better able to withstand remote storage. Further crew reductions came about as the USAF determined that ten armed launch facilities (LFs) could each be remotely manned from a single command center or missile alter facility (MAF). LFs surrounded their MAF, with each LF positioned at least three miles from adjacent LFs for survivability. A MAF was able to continually monitor the operational status and security of its ten LF as well as initiate missile launch via an underground cable system, called the Hardened Intersite Cable System (HICS). The four MAF/LF instillations of a squadron were also interconnected by HICS, enabling the monitoring and control all 50 of the squadron's missiles from a single facility.

An LF had two primary structural components: the launcher and launcher support building (LSB). The launcher was a large cylindrical tube set within a cylindrical structure that allowed for missile storage and launch as well as side space for control and communication equipment and batteries. It lay almost entirely underground and was a "hard" structure intended to be resistant to the effects of a nuclear blast with the exception of a direct hit. Equipment necessary for maintaining the missile when on prolonged strategic alert was housed in the LSB. Unlike the launcher, however, the LSB was a "soft" structure unable to sustain attack.

As the USAF further developed Minuteman missiles, alternations to the LF occurred to accommodate the changes. Early alterations of the mid-1960s included extension of the launch tube to make room for longer and more powerful Minuteman II missiles, and the installation of seat bearing rings and circuit-breaking equipment,. Upgrades were also made to the electronic ground-support equipment and electronic fibers associated with communication equipment.

The structural aspects of the launch support building were also significantly improved. Most notable was the hardening of the building and the addition of shock mounts to dissipate electromagnetic pulses or tremors resulting from the spread of nuclear radiation. Renamed the launcher equipment building (LEB), the new Minuteman II support building provided for a two-week period of survivability if needed for shelter by personnel.

In the early to mid-1970s, the transition from Minuteman II to Minuteman III missiles resulted in significant changes to the internal operating systems of a LF. The launch tube of existing Minuteman II launchers, however, did not require structural alterations to accommodate Minuteman III missiles. Similarly, upgraded or new internal systems could be installed at an LEB without any major modification of the structure itself.

New technologies continued to be incorporated in the Minuteman III. The most significant of these was the REACT system, considered the most advanced command and control system upgrade in the history of the Minuteman missile. It was a state of the art upgrade that occurred in 1996 at the cost of $650 million.[1] The REACT system cut the retargeting time in half. The previous command and control system, the Command Data Buffer, required approximately 20 hours to retarget the entire Minuteman force and approximately two hours to retarget an individual element. The REACT system reduced retargeting the entire Minuteman force to 10 hours and individual elements to a matter of mere minutes.[2] Minuteman II squadrons had REACT-A systems and Minuteman IIIs REACT-B system. REACT-A system ran solely through the hardened intersite cable system while REACT-B systems utilized the HICS as well as radio signals.

Quebec-19 LF Description

The Quebec1-19 is an excellent representative example of a launch facility upgraded from a Minuteman II (mid-1960s) to a Minuteman III installation (mid-1970s). It has four primary components: the launcher, the launcher equipment building (LEB), the service area, and the launch facility security system (LFSS). The service area is the only component completely above ground. It is the "topside service area surrounding the launcher and the LEB/LSB [launcher support building]."[3] The service area is a

[1] John Pike, "Rapid Execution and Combat Targeting," 2008.
[2] Ibid.
[3] Ken Parsons, "341 CES/CEVC Minuteman Weapon Generalization Familiarization Handbook," (Malmstrom Air Force Base: Missile Engineering QA Office, 1997), 1-5.

predominantly gravel area used for maintenance and support vehicles of personnel servicing the LF. The remaining three components have features above and below ground.

The majority of the Quebec-19 LF is below ground. The LF is a "hard" structure, designed to withstand nuclear attack, and with two primary components: the launcher and the LEB. The launcher is the larger of the two areas and is a large cylindrical tube set within a cylindrical structure that allows for missile storage and launch as well as side space for control and communication equipment and batteries. The launcher has four sub-components: the launcher closure, the launcher equipment room (LER), the launch tube, and the personnel access system. Of these four sub-components, one is above ground, two run the depth of the structure, and one is completely below ground.

The launcher closure is the only above-ground sub-component of the launcher. The purpose is to protect the Minuteman missile from the effects of a nuclear attack, including nuclear blast pressure and thermal effects. It is a 4½-foot (ft) thick steel-reinforced concrete slab that rests over the launch tube when closed.[4] The launcher closure sits on a steel bearing ring that encircles the launch tube top and the beveled edges, as well as the weight of the door, prevent vertical movement. When the launch command is issued, a ballistic actuator comprised of ballistic gas opens the launcher closure by the means of four 18 inch (in) steel wheels.[5] Debris-catcher bins are located in the launcher closure door to catch debris from the opening to prevent it from hitting the missile at launching. The south elevation of the launcher closure slopes downgrade for water drainage. The launcher closure is opened manually by a hydraulic pusher when maintenance is necessary.

The launch tube is the cylindrical tube that physically stores the 60 feet in height by 6 feet in diameter Minuteman III missile. It is also the launch location of the missile. It is 95 ft in depth and has a steel liner that protects the missile from such problems as flying debris during launch, electromagnetic interference, and even surface erosion.[6] Other protective measures within the launch tube include a suspension system for the missile against ground motion (tremors) or the effects of a nuclear attack and a sump pump to remove ground water. The suspension system also assists with missile alignment by having rotation capabilities.

The LER is the cylindrical concrete structure that encircles the upper portion of the launch tube. There is an upper level LER and a lower level LER that is differentiated by the shock mounts in the upper level LER. Equipment in the LER includes power supply group, battery charger, ultra high frequency (UHF) radio receiver group, periscope mount, light distribution box panel, and guidance section liquid cooler.[7] The LER is

[4] Ibid.
[5] Ibid.
[6] Ibid.
[7] Ibid.

separated from the launch tube by a rattle space, which is a six to eight inch gap that allows motion in response to ground motion or effects of nuclear attack without structural damage.

The personnel access system allows personnel to enter the launcher. It has a primary door opening to a folding ladder that leads down a shaft to the upper level of the launcher.[8] The primary door also acts as the security measure against unauthorized entrance. Next to the primary door is a security pit, respectively called A plug and B plug. The weather cover of the security pit must be opened to access the vault door that allows access to the primary door locking mechanism, which must be retracted to open the primary door. Once the primary door is open, the B plug in the security pit caps a 42-inch-diameter shaft.[9] The locking mechanism of the secondary doors is retracted, and the door is lowered, allowing access to the launcher.

Sitting to the side of the launcher is the LEB. The LEB is a "hard" structure with equipment to keep the Minuteman III missile on prolonged strategic alert.[10] It measures 15 ft by 15 ft and is divided into two areas: the access area and the equipment room. Like the launcher, the LEB has a personnel access system, although in the LEB it is a less complex system of a steel hatch that opens onto a ladder into a two-story, rectangular access area. A larger steel hatch is located nearby for equipment loading. This opening does not have a ladder but allows for equipment to be lowered down or pulled out. The equipment room is not rectangular, but is instead a capsule in the style found in the MAF Launch Control Center (LCC). Equipment such as generators, fuel pumps, air exhaust, security panels, distribution panels, diesel tanks, telephone equipment, and air compressors sit on a platform suspended on pneumatic shock isolators. The equipment room is separated from the access area by an eight-ton blast door.

The final component of Quebec-19 LF is the Launch Facility Security System (LFSS). The LFSS is not immediately visible because it primarily consists of antennae, switches, and tunneling detectors. The LFSS divides into two areas: the outerzone (OZ) and the innerzone (IZ). The OZ is above ground and detects surface activity through radio frequency surveillance and switches on the LEB and the personnel access system.[11] Several types of antenna are found within the service area and include UHF radio receiver antenna, sensor electromagnetic pulse antenna, and OZ radio frequency security antenna. The Improved Minuteman Physical Security System (IMPSS) Antenna replaced the original antenna (the OZ radio frequency security antenna), which was identified by MAFB staff as existing onsite but has since been removed.[12] The date of its removal was unknown. The IMPSS is a white fiberglass monopole antenna located on

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[8] Ibid.
[9] Ibid.
[10] Ibid.
[11] Ibid.
[12] Parsons, 1-5; Ken Parsons and Mr. Anthony Lucas, 341 CES/CEVC, interview by Mathia Schereer, 16 October 2007.

the closure door. It is a micro-processor based surveillance system that detected launch site intruders within the OZ.[13] The IMPSS replaced the OZ radio frequency security antenna because the sensitive system was sounding an alarm when wildlife wandered into the range of the antenna. The IZ functions through a combination of switches and vibration (tunneling) detectors.[14] The switches for both the OZ and the IZ are magnetic or micro-type magnetically operated and are either individual switches or a series of switches.[15] Tunneling detectors are located within the launcher walls and detect vibrations. Any security violations are sent to the LCC.

Current Status of the 564th MS at Quebec-19 LF

In 2006, US defense leaders and the Quadrennial Defense Review decided to deactivate the 564th MS given the 564th MS operated under the REACT-B system while the remaining squadrons operated under the REACT-A system. The cost of operating and training for this separate control and command system resulted in approximately $10 million in additional defense spending annually. The deactivation of the 564th MS meant the removal of the missiles and missile components from the MAFs and associated LFs. This effort began on 12 July 2007 when the first missile was removed from Sierra-38 LF. The USAF planned to remove one missile per week for the remainder of 2007, with the final missile being removed in July 2008. The 564th MS was officially deactivated on 15 August 2008. The Quebec-19 LF had been stripped of its missile and primary missile components when the structure was documented in October 2007.

ACRONYMS

HICS	Hardened Intersite Cable System
ICBM	Intercontinental Ballistic Missile
IMPSS	Improved Minuteman Physical Security System
IZ	Innerzone
LCC	Launch Control Center
LEB	Launcher Equipment Building
LER	Launcher Equipment Room
LF	Launch Facility
LFSS	Launch Facility Security System
LSB	Launcher Support Building
MAF	Missile Alert Facility
MAFB	Malmstrom Air Force Base
MIRV	Multiple Independently Reentry Vehicle

[13] Christina Slattery et al, "Minuteman ICBM Launch Control Facility Delta 0-1 and Launch Facility Delta 0-9, Ellsworth Air Force Base National Register of Historic Places Nomination Form," http://www.nps.gov/archive/mimi/history/srs/hrsab.pdf, 2003Slattery et al, 2006.

[14] Parsons, 1-5.

[15] Ibid.

MS	Missile Squadron
MW	Missile Wing
USAF	United States Air Force
OZ	Outerzone
UHF	Ultra-High Frequency

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Parsons, Ken and Anthony Lucas, 341 CES/CEVS, Malmstrom Air Force Base. Interview by Mathia Scherer, 16 October 2007.

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